Marginal Ice Zone DRI

Ice Mass Balance Buoys- Wilkinson, Hwang (SAMS), Maksym (WHOI)

Wave Buoys- Wadhams (Cambridge), Doble (Laboratoire d'Oceanographie de Villefranche)

Wave Measurements- Thomson (APL-UW)

Acoustic Navigation and Wavegliders- Freitag (WHOI)

Profiling Floats- Owens, Jayne (WHOI)

Ice-Tethered Profilers- Toole, Krishfield, Cole, Thwaites (WHOI), Timmermans (Yale)

Autonomous Ocean Flux Buoys- Stanton, Shaw (NPS)

Autonomous Gliders- Lee, Rainville, Gobat (APL-UW)

MIZMAS model- Zhang, Schweiger, Steel (APL-UW)

Regional Arctic Climate System Model- Maslowski, Roberts, Cassano, Hughes (NPS)

Arctic Nowcast/Forecast Model- Posey, Allard, Brozena, Gardner (NRL)

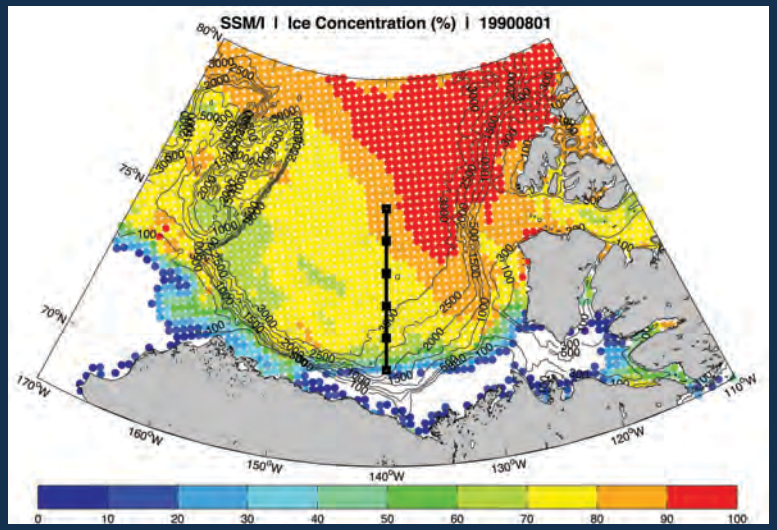
Seasonal MIZ in the Beaufort Sea

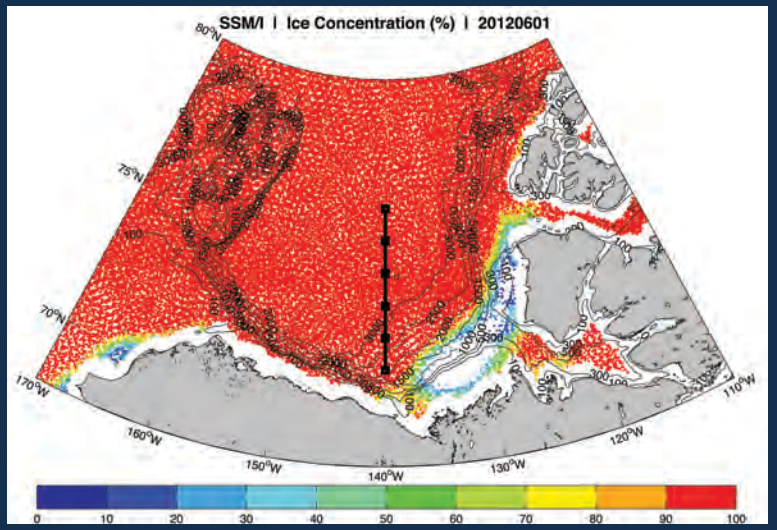
1990

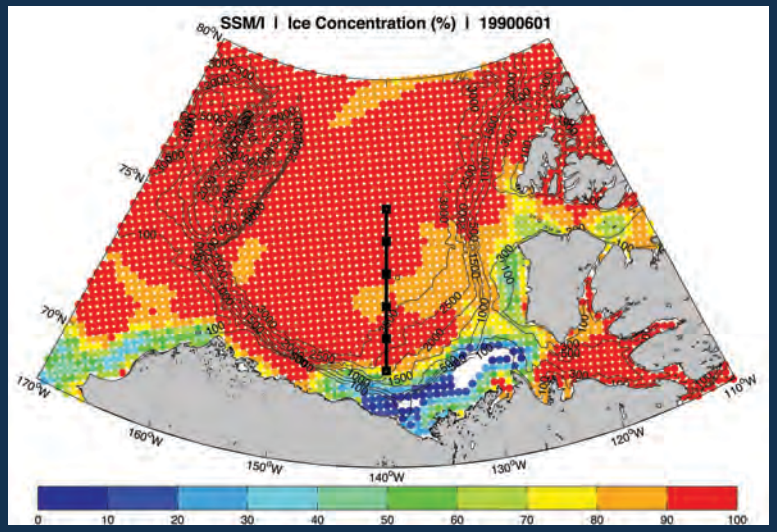
2012

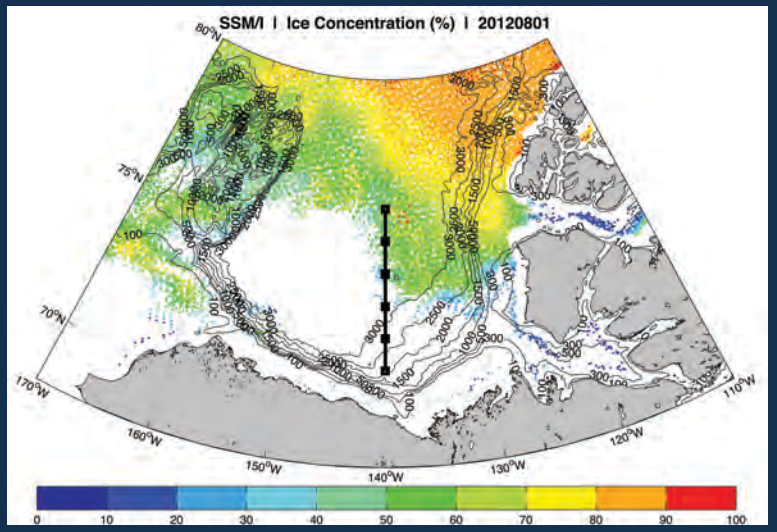
June

August



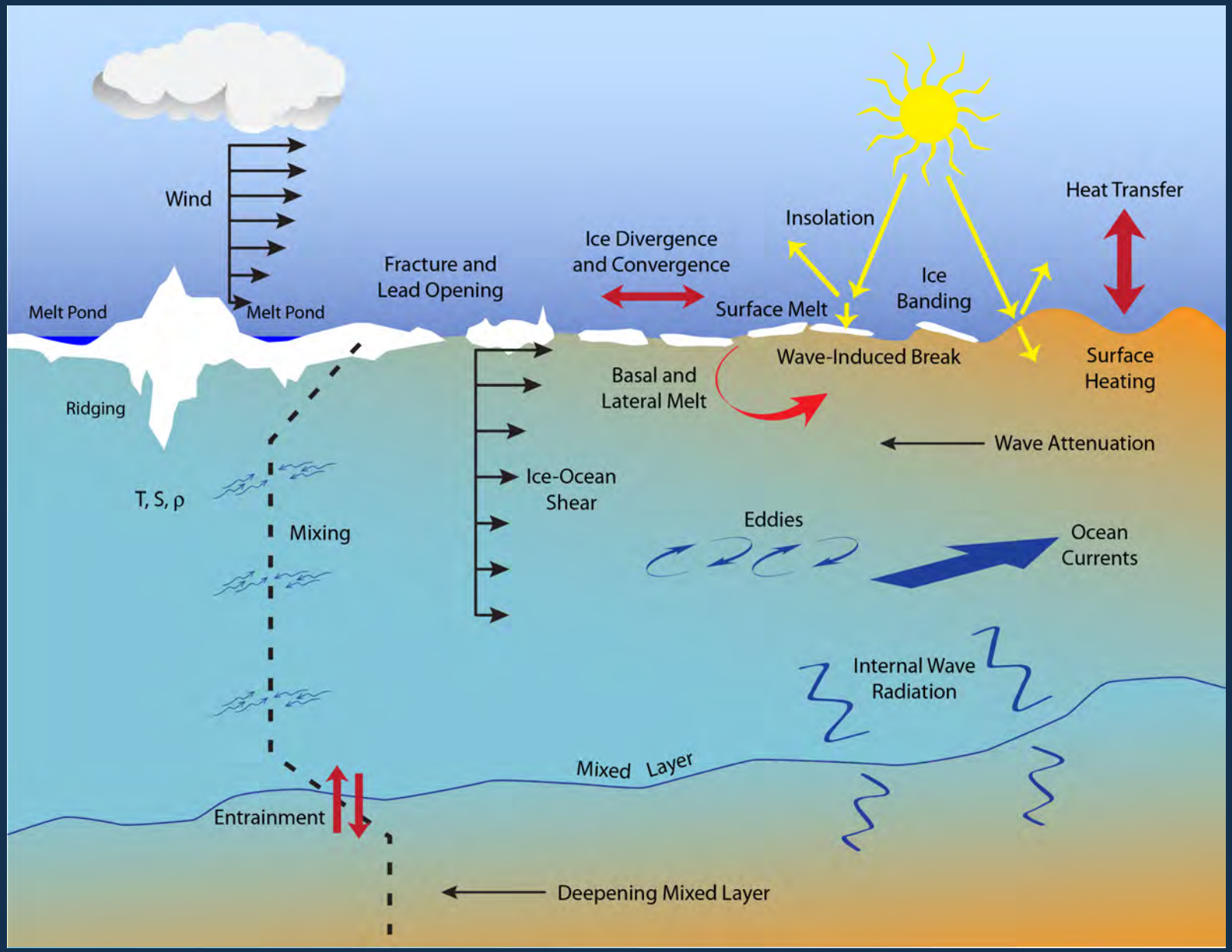






SSM/I - Posey

Processes Governing Atmosphere-Ice-Ocean Interaction



Science Objectives

1. Collect and analyze a benchmark dataset that resolves the key processes controlling MIZ evolution, with sufficient spatial and temporal scope to capture a broad, representative range of environmental conditions.

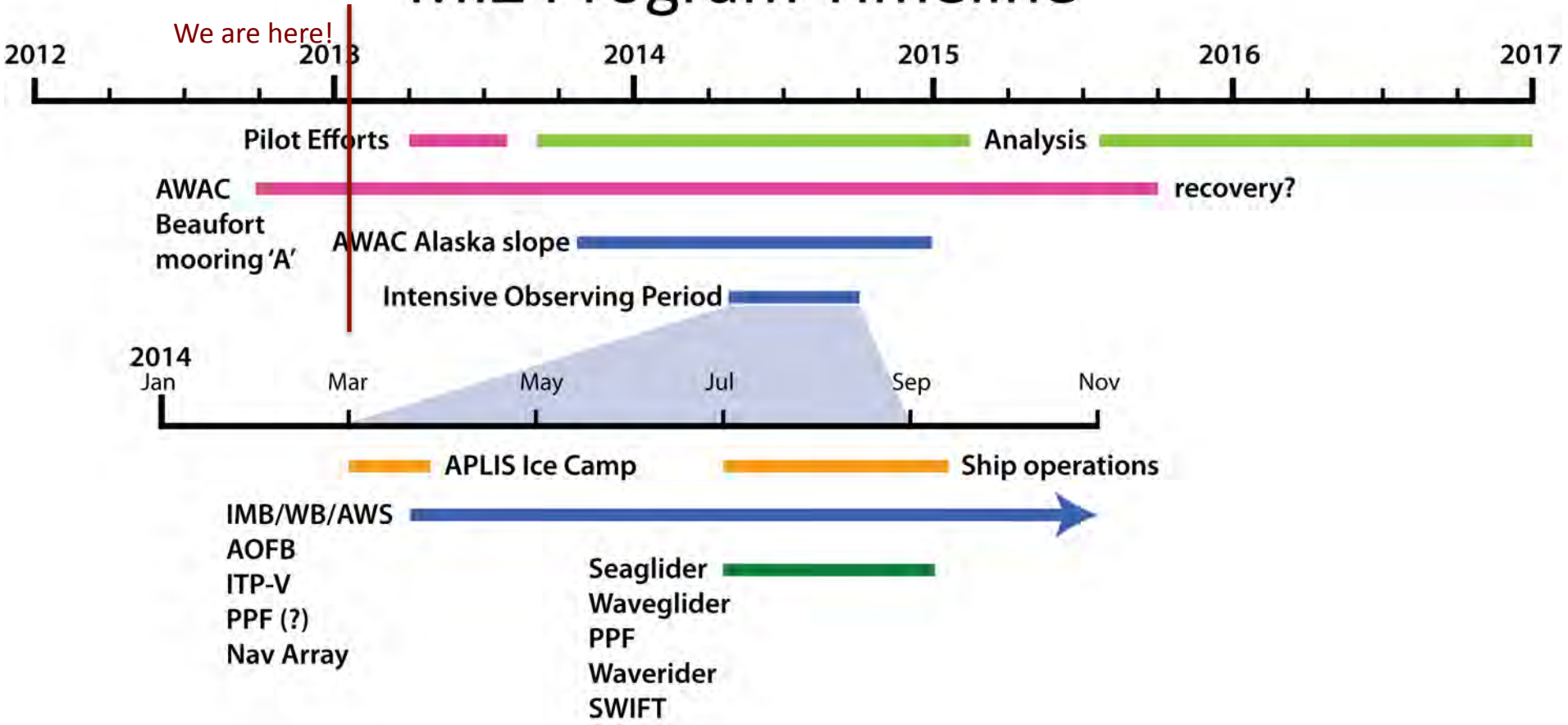
2. Understand the processes that govern the evolution of the marginal ice zone. Identify key interactions and feedbacks in the ice-ocean-atmosphere system and investigate how these might change with the predicted increased seasonality in Arctic sea ice cover.

3. Evaluate the ability of existing models to predict MIZ seasonal evolution. Improve parameterization of key processes with the goal of enhancing seasonal forecast capability.

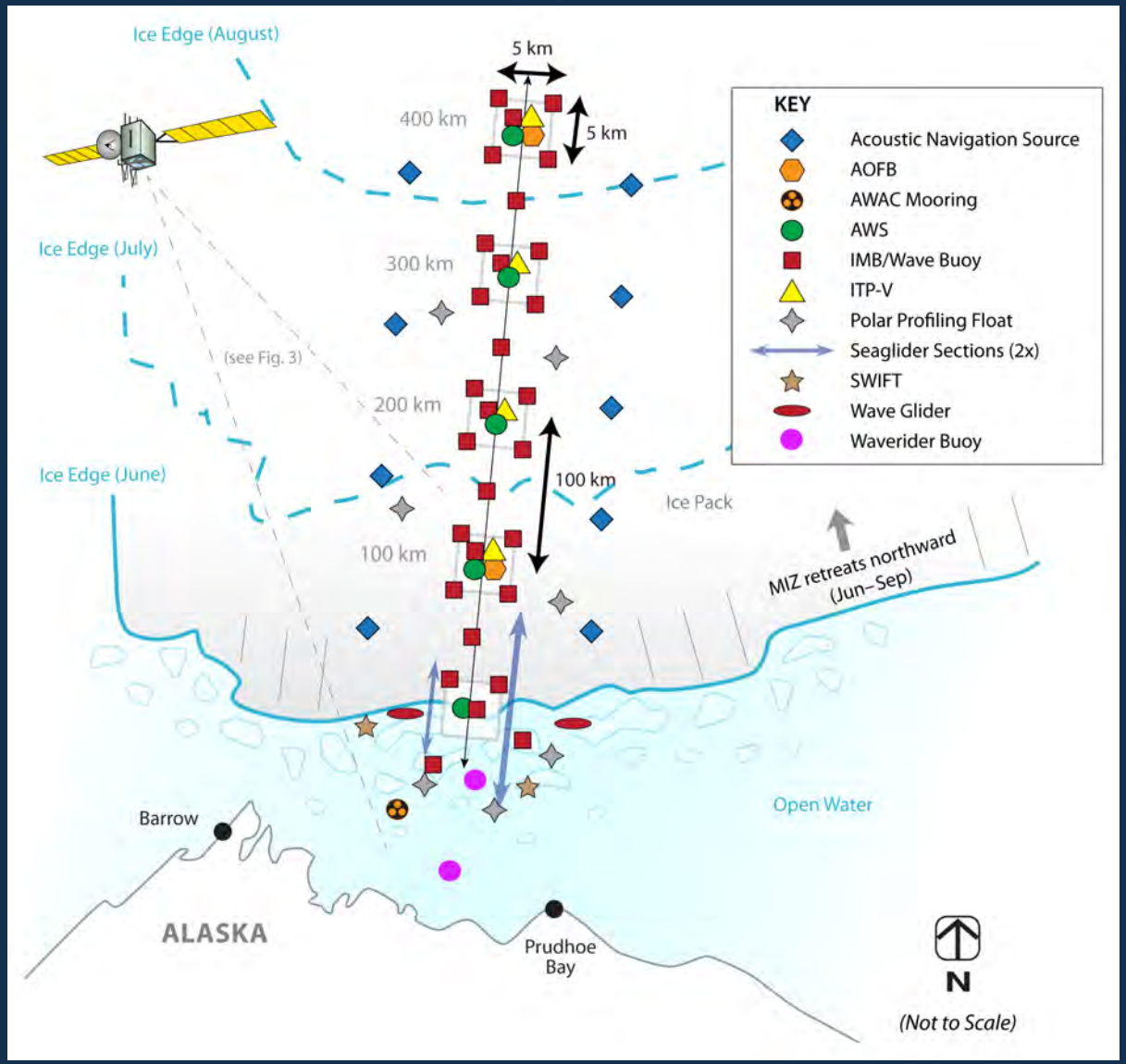
Technological Objectives

1. Develop and demonstrate new multi-sensor, autonomous networks for collecting persistent observations in and under sea ice, and within the nearby open waters.
    - Ice-mass balance, motion (waves)
    - Ice-based upper ocean observations
    - Ice-capable drifters, floats and gliders
    - Acoustic infrastructure (navigation and communications)
    - Strategies for integrated observing
2. Advance interpretation of satellite remote sensing retrievals.

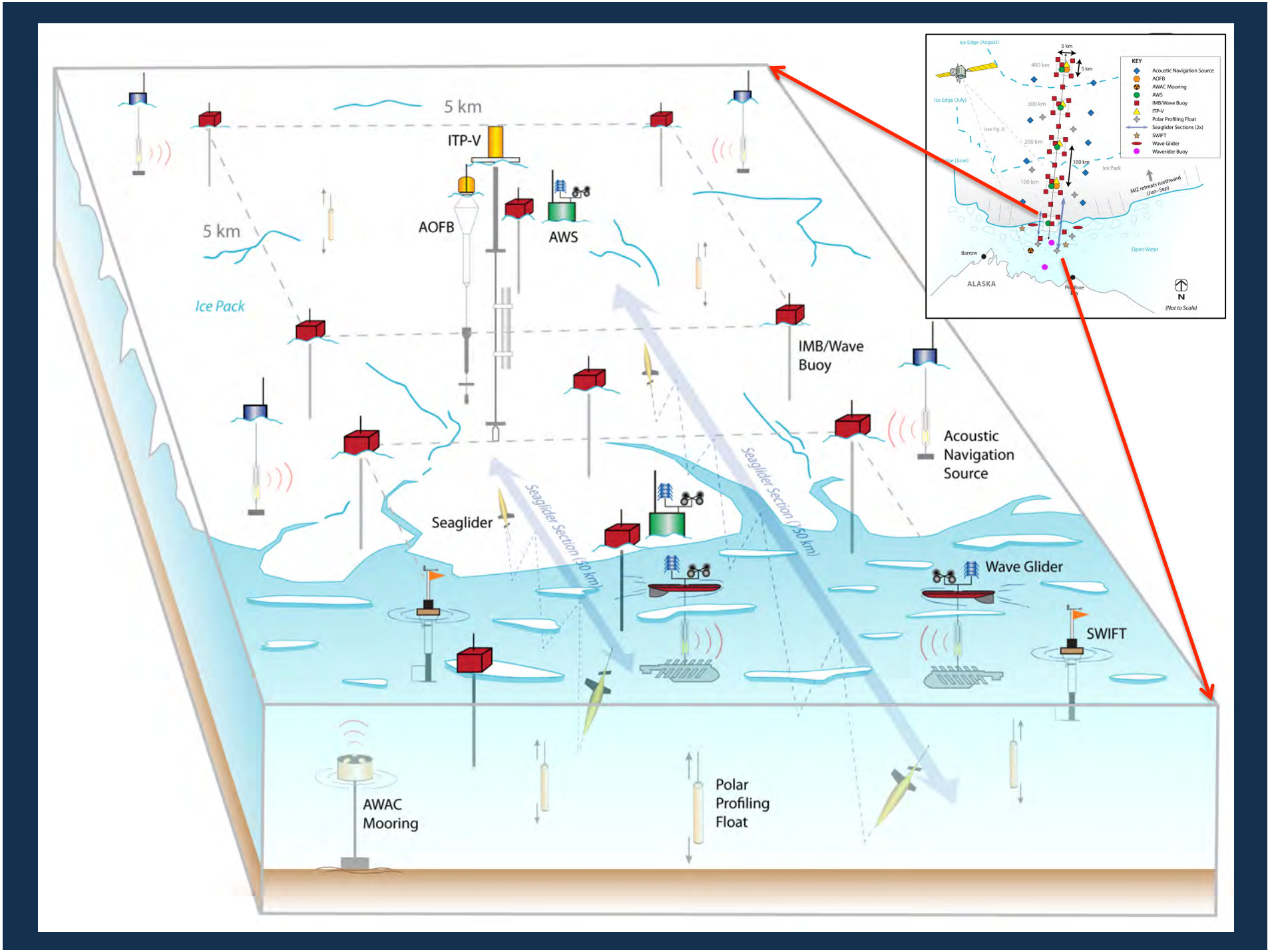
MIZ Program Timeline



Observational Approach



- 'Lagrangian' array drifts with ice pack- follow evolution of target region through entire season.
- Maintains focus on MIZ by following northward retreat of ice edge.
- Intensive ice-based array.
- Drifting platforms in open water.
- Mobile platforms span ice-free, MIZ and ice-covered regions.

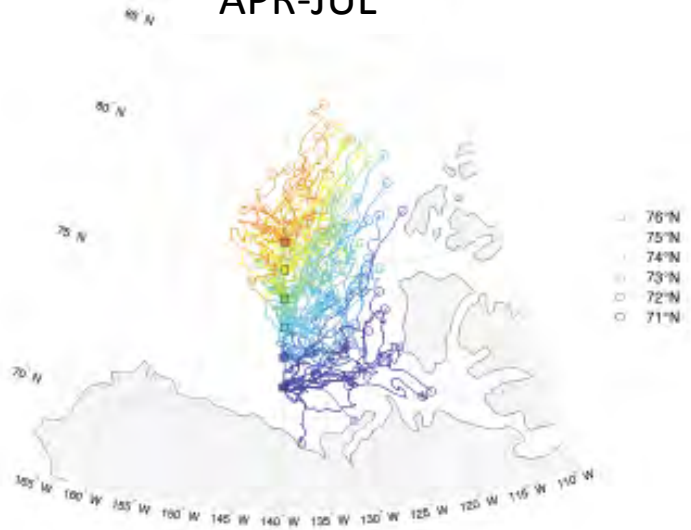

5 km
ITP-V
5 km
AOFB
AWS
Ice Pack
IMB/Wave
Buoy
Acoustic
Navigation
Source
Seaglider
Seaglider Section (150 km)
Seaglider Section (150 km)
Wave Glider
SWIFT
AWAC
Mooring
Polar
Profiling
Float
Ice Edge (August)
Ice Edge (July)
Ice Edge (June)
Ice Pack
MIZ retreats northward (Jun - Sep)
Open Water
Barrow
ALASKA
Prudhoe Bay
N
(Not to Scale)
KEY
Acoustic Navigation Source
AOFB
AWAC Mooring
AWS
IMB/Wave Buoy
ITP-V
Polar Profiling Float
Seaglider Sections (2x)
SWIFT
Wave Glider
Waverider Buoy

Spring Ice Camp (March/April 2013)

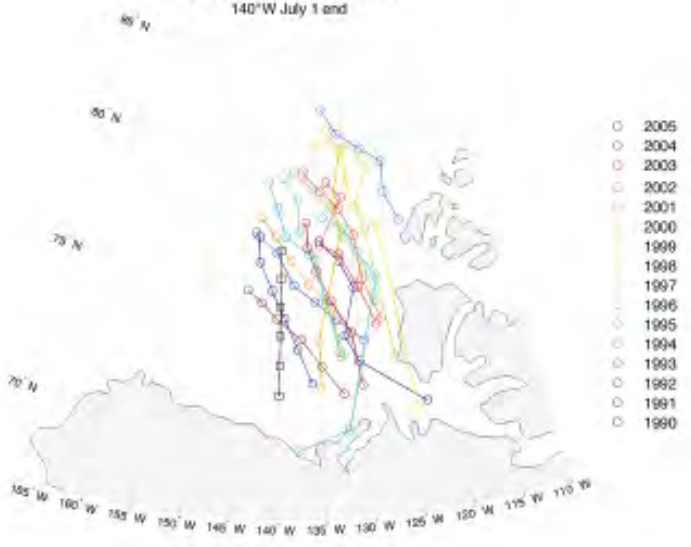
- Lightweight, focus on deploying autonomous assets.
- Flexible – established by MIZ program.
- Aircraft support – fixed wing and helicopter.
- Potential opportunities for in situ measurements.
- Stanton/Shaw plan turbulence profiling.
- Aircraft remote sensing measurements planned through partnerships with other programs.
- Additional ice-based measurements?
- Biological/biogeochemical observations? Calibration and proxy building?

Ice Drift and Initial Targeting

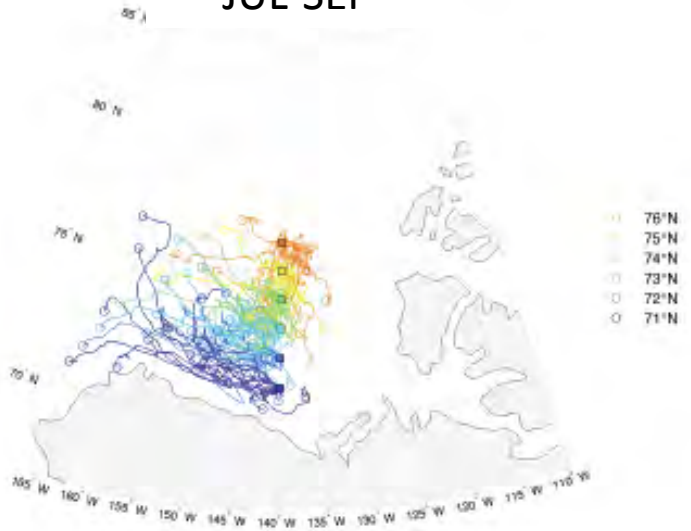
APR-JUL



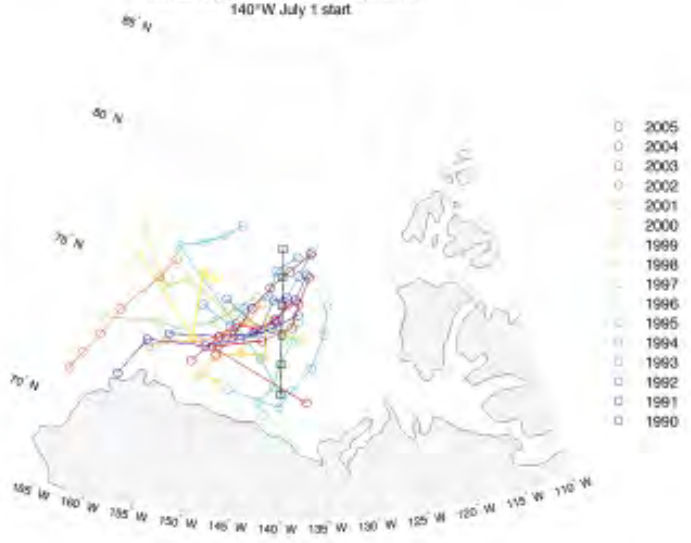
RACM April 1 ice drift start positions
140°W July 1 end



JUL-SEP

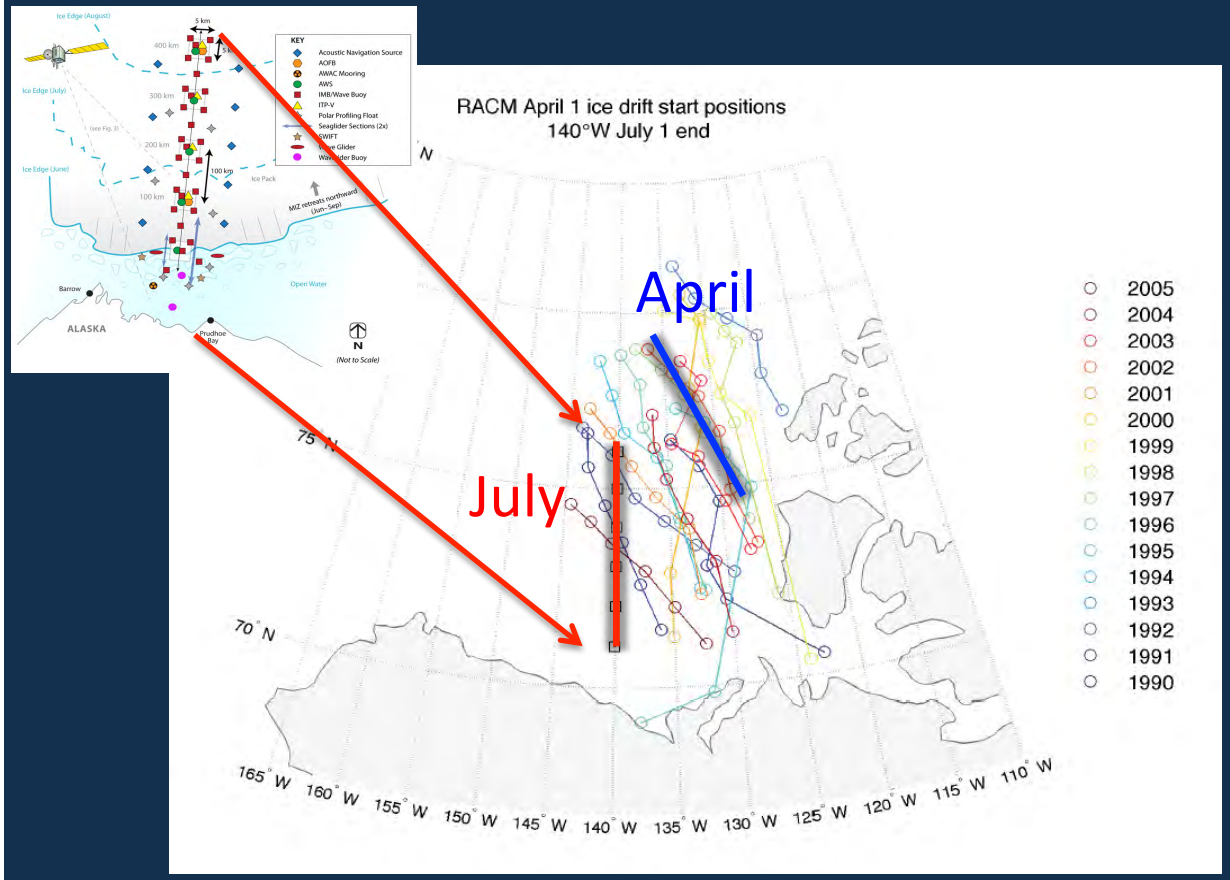


RACM September 1 ice drift end positions
140°W July 1 start



NPS RACM - Maslowski

MIZ Operational Approach

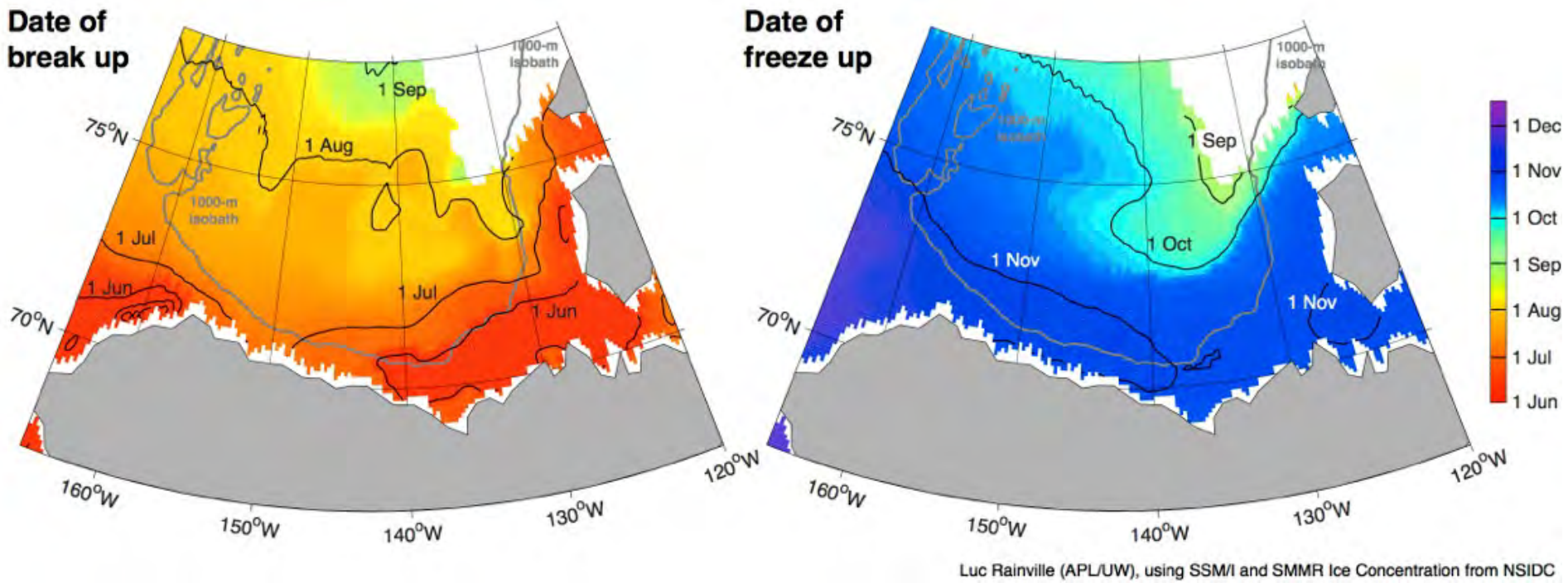


- Plan involves risk- drift, dispersion, instrument loss…
- Sites nearest the MIZ are most interesting. Northern sites important late summer, as the MIZ approaches.
- Mitigate risk by deploying northern cluster late- allows targeting in response to existing conditions.

- Ice-based array deployed by aircraft in April (full ice cover).
- Northernmost site logistically difficult.
- Ice-based array drifts westward and southward with some dispersion.
- Drifters, floats & gliders deployed in early July, after open water forms along the coast. Follow MIZ retreat & array drift.
- Continue drift, sampling until autumn freeze-up.

When to Deploy and Recover Assets?

Date of the break up and freeze up of the seasonal ice cap in the Canada Basin in 2011.
(earliest and latest dates of 50% ice concentration)



Luc Rainville (APL/UW), using SSM/I and SMMR Ice Concentration from NSIDC

- Robust ice-cover required for aircraft operations (ice-based instruments).
- Open water required for drifters, floats & gliders.
- Capture MIZ evolution from initial formation to end of season.
- Measure in full ice cover, across the MIZ and into open water.
- Recover prior to freeze-up.

Collaborations with Other Programs

- Seasonal Ice Zone **Reconnaissance Surveys (ONR)**
- Marginal Ice Zone Observations and Process Experiment (NASA, NOAA)
- Determining the Impact of Sea Ice Thickness on the Arctic's Naturally Changing Environment (Naval Research Laboratory)
- ICEBridge (NASA)